# REPORT

ON THE

# HEALTH OF THE BOROUGH

OF

# GREAT YARMOUTH,

FOR THE YEARS 1876 & 1877.

BY

JOHN BATELY,

L.R.C.P., LOND., M.R.C.S., L.S.A., MEDICAL OFFICER OF HEALTH.

Printed by Order of the Sanitary Authority.

Great Yarmouth:
COOPER AND SON, STEAM PRINTERS.

1878.

Digitized by the Internet Archive
in 2017 with funding from
Wellcome Library

https://archive.org/details/b29267833

TO THE

GREAT YARMOUTH

# URBAN SANITARY AUTHORITY.

GENTLEMEN,

I beg to submit for your consideration my Report upon the Sanitary condition of the Borough of Great Yarmouth, for the years 1876 and 1877.

These years were on the whole successful years. Larger measures of sanitary improvement were carried out, and apparently with better results than in any immediately preceding.

Unquestionably Yarmouth is the most popular watering place on the eastern coast, and with a lively appreciation of this fact, the Sanitary Authority has done much to render it the most healthy.

Although our sanitary expenditure is somewhat large, the inhabitants are gaining doubly thereby; for not only does the number of our visitors increase every year, but the health and happiness of the residents much improve.

## SECTION I.

### POPULATION.

It is calculated that at least 1650 souls were added to the population during 1876 and 1877; thereby making the estimated total 45,800 in 1876 and 46,650 in 1877.

This increase is apportioned, in the table below, to each of the three districts in relative numbers to their known additions.

No reliable estimate can be offered of the total number of strangers who, for business or pleasure, visit Yarmouth during the year. In the spring the two Militia Regiments assemble here for their annual training. In summer a large number of visitors (about 60,000 annually) flock to the seashore. And in the autumn the herring-fishing draws to Yarmouth a vast crowd of fishermen from all parts of the eastern counties, and from the fishing districts along the north of England and Scottish coasts. The shipping population of the harbour and roadstead is ever varying, but at no time inconsiderable in amount.

### BIRTHS AND DEATHS.

During the year 1876 there were registered by the three Registrars within the Borough,* 1490 births and 920 deaths.

In 1877, 1490 births and 900 deaths were recorded. It is singular how the figures of the two years correspond.

The natural increase of the population was 570 in 1876 and 590 in 1877.

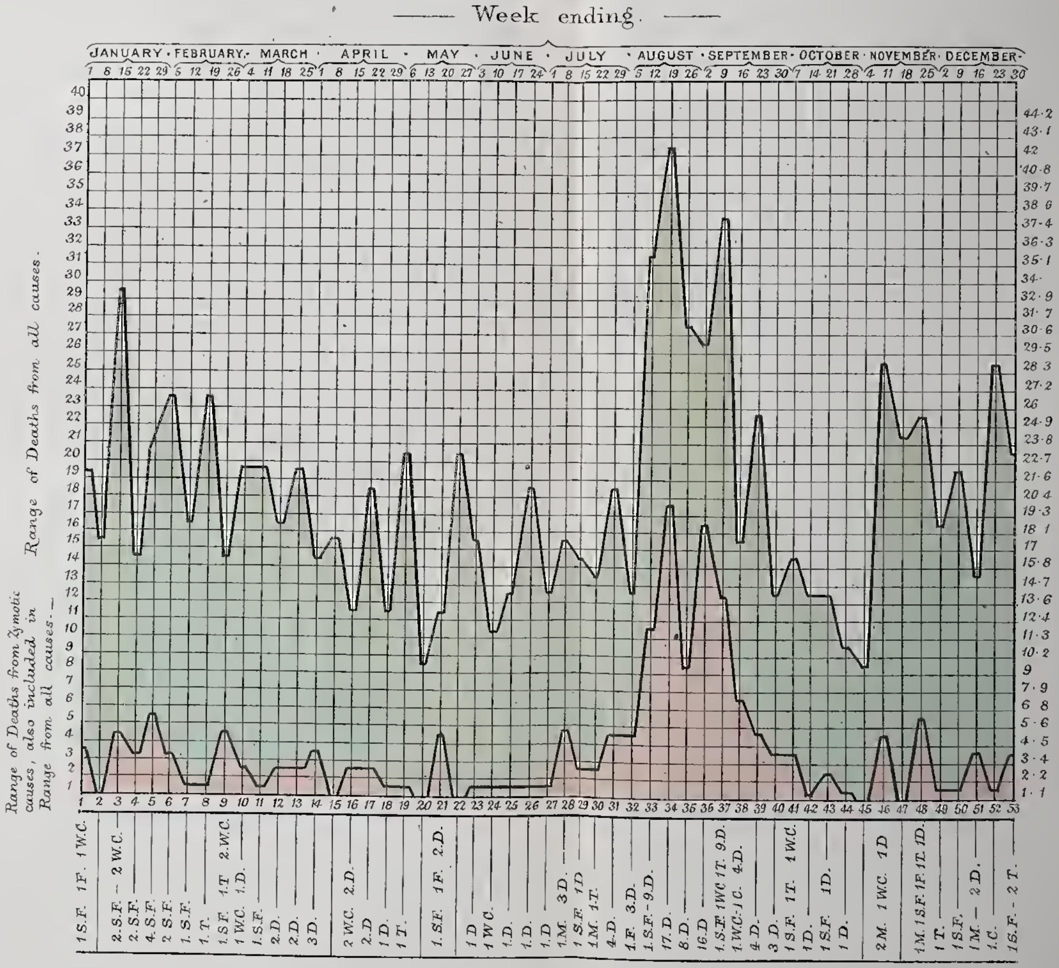
| | | |
|---|---|---|
| The Birth-rate in | 1876 was | 32·53. |
| ,, | 1877 ,, | 31·93. |
| The Death-rate in | 1876 was | 20·08. |
| ,, | 1877 ,, | 19·29. |
| The rate of Increase in | 1876 was | 12·45. |
| ,, | 1877 ,, | 12·64. |

---

* It is but right to observe, the above figures apply to the Borough of Great Yarmouth only, and that the Births and Deaths occurring in that portion of the Gorleston Registration Sub-district outside the limits of the Borough, are purposely omitted. The calculations for 1877 are based upon the 52 weeks ending Saturday, December 29th.

# A DIAGRAM EXHIBITING THE NUMBER OF DEATHS REGISTERED WEEKLY IN THE BOROUGH OF GREAT YARMOUTH, DURING THE YEAR 1876.

*The weekly Rate of mortality is calculated on a Population of 45,800.*



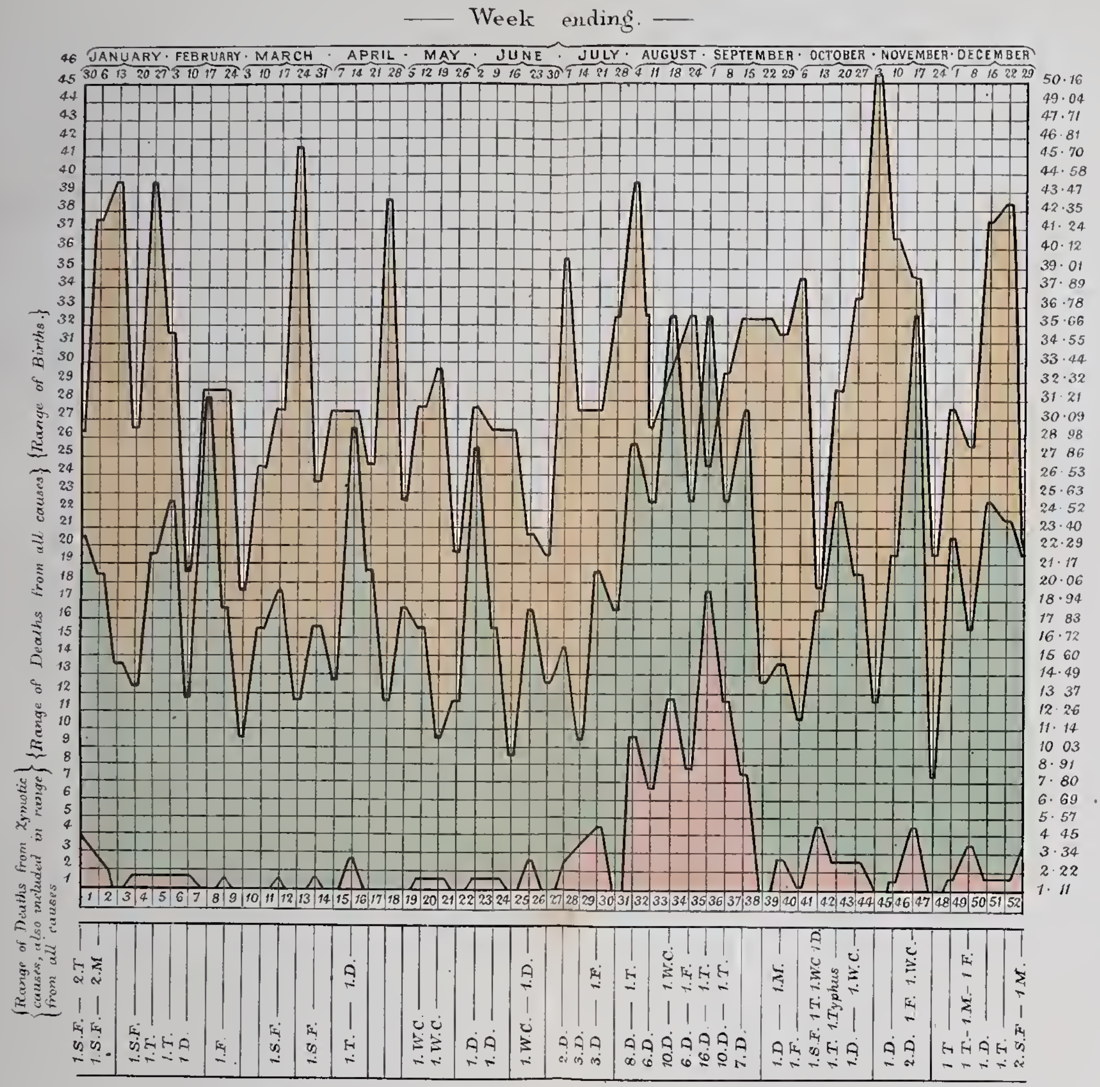
Contractions: W.C. Whooping Cough. S.F. Scarlet Fever. D. Diarrhea. T. Typhoid. F. Fever. C Cholera M. Measles.

Compiled by J. Bately L.R.C.P. Lond<sup></sup>.
Medical Officer of Health

J. Wm. Cockrill delt

# A DIAGRAM EXHIBITING THE NUMBER OF BIRTHS AND DEATHS REGISTERED WEEKLY IN THE BOROUGH OF GREAT YARMOUTH, DURING THE YEAR 1877.

*The weekly Rates are calculated on a Population of 46,650.*



Contractions: *W.C. Whooping Cough. S.F. Scarlet Fever. D. Diarrhéa. T. Typhoid. F. Fever. M. Measles.*

*Compiled by John Bately L.R.C.P. London.*
*Medical Officer of Health.*

*J.Wm Cockrill deltr*

The annexed Diagrams exhibit the weekly Death Rate throughout the two years, and the subjoined Table gives further particulars.

### QUARTERLY RETURNS OF BIRTHS AND DEATHS.

| YEAR. | DISTRICT. | BIRTHS. | | | | | | DEATHS. | | | | | | Increase per 1,000. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Quarters ending. | | | | | | Quarters ending. | | | | | | |
| | | 31st March. | 30th June. | 30th Sept. | 31st Dec. | TOTAL. | Per 1,000. | 31st March. | 30th June. | 30th Sept. | 31st Dec. | TOTAL. | Per 1,000. | |
| 1876. | NORTHERN...<br>Est. Pop. 20,745 | 156 | 162 | 167 | 160 | 654 | 31·04 | 116 | 97 | 135 | 121 | 469 | 22·12 | 8·92 |
| | SOUTHERN ...<br>Est. Pop. 16,820 | 128 | 133 | 150 | 150 | 561 | 33·94 | 84 | 62 | 114 | 74 | 334 | 19·85 | 14·09 |
| | GORLESTON and SOUTHTOWN.<br>Est. Pop. 8,235 | 70 | 66 | 68 | 80 | 284 | 34·49 | 43 | 20 | 32 | 22 | 117 | 14·20 | 20·29 |
| 1877. | NORTHERN...<br>Est. Pop. 21,043 | 168 | 138 | 197 | 163 | 666 | 31·64 | 103 | 93 | 134 | 127 | 457 | 21·71 | 9·93 |
| | SOUTHERN ...<br>Est. Pop. 17,105 | 132 | 123 | 129 | 142 | 526 | 30·75 | 76 | 78 | 97 | 78 | 329 | 19·23 | 11·52 |
| | GORLESTON and SOUTHTOWN.<br>Est. Pop. 8,502 | 73 | 69 | 66 | 87 | 295 | 34·69 | 28 | 23 | 34 | 27 | 112 | 13·17 | 21·52 |

The Death-rate in the Northern district includes—
In 1876—57 at the Workhouse and 16 inquests.
In 1877—65 ditto 20 ditto.

That in the Southern district— [14 inquests
In 1876—9 at Public Hospital, 24 at Naval Asylum, and
In 1877—8 ditto 10 ditto 21 ditto.

That in the Gorleston and Southtown district—
In 1876—2 inquests.
In 1877—7 ditto.

Remembering the increase of the population, it is most satisfactory to notice the gradual yearly decrease in the number of Deaths, not merely in proportion to the population but in actual numbers. The juxta-position of the cardinal figures for the three last years will render this more evident.

| | | 1875. | 1876. | 1877. |
|---|---|---|---|---|
| No. of Births | ... | 1434 | 1490 | 1490 |
| No. of Deaths | ... | 1036 | 920 | 900 |
| Birth-rate | ... | 31·8 | 32·53 | 31·93 |
| Death-rate | ... | 23·02 | 20·01 | 19·29 |
| Rate of Increase | ... | 8·7 | 12·45 | 12·64 |
| Zymotic Deaths | ... | 201 | 155 | 109 |
| Ditto, Death-rate | ... | 4.6 | 3.3 | 2.3 |

### OF ZYMOTIC DEATHS.

There were 155 = 3·3 per 1000 in 1876,
and 109 = 2·3 per 1000 in 1877.

These deaths are included in the totals for the two years, but being those sanitary measures tend to prevent, more particular attention is given to them here. The table below gives their nature and the period of the year in which they occurred.

| | 1876. | | | | | 1877. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1st Qr. | 2nd Qr | 3rdQr. | 4thQr. | Total. | 1st Qr. | 2nd Qr | 3rdQr. | 4thQr. | Total |
| Measles . | | | 2 | 4 | 6 | 1 | | 1 | 2 | 4 |
| Scarlet Fever .. | 13 | 1 | 3 | 5 | 22 | 4 | | | 3 | 7 |
| Whooping Cough | 6 | 2 | 2 | 2 | 12 | | 3 | 1 | 3 | 7 |
| Fever .. | 4 | 2 | 3 | 7 | 16 | 3 | 2 | 5 | 9 | 19 |
| Diarrhœa .. | 7 | 7 | 78 | 6 | 98 | 1 | 2 | 63 | 6 | 72 |
| Cholera .. | | | 1 | | 1 | | | | | |
| | | | | | 155 | | | | | 109 |

MEASLES exhibited itself slightly in the third and fourth quarters of 1876, and in the first, third, and fourth of 1877.

SCARLET FEVER was busy in the first quarter of 1876, and it lingered through the year to the first quarter of 1877. The two middle quarters of that year were entirely free, but in the last quarter it again appeared; however, it went not beyond a few sporadic cases.

WHOOPING COUGH, generally associated with Bronchitis, found a place in each quarter of the two years, except the first of 1877.

Of all the Fever deaths in the two years only one was due to TYPHUS, and twenty-five to TYPHOID, a disease singularly connected with bad water and bad drainage. The specific characters of the remaining cases were not indicated.

Unfortunately Yarmouth frequently suffers for sins not her own, for during the visiting season, fever cases, convalescent and otherwise, are brought to the sea-side, and to prevent as far as possible the dissemination of the infection, all lodging-houses should be registered, placed under direct sanitary supervision, and the occupiers required to give immediate notice to the Medical Officer of Health of the occurrence of fever in their houses.

The ugliest blot that occurs in the list of deaths due to preventible causes is DIARRHŒA, which alone counted 98 in 1876 and 72 in 1877. Such large mortality received special notice from the Registrar General, who in his third quarterly report for 1876, at page viii, says:—"In the fifty towns, the Diarrhœa-rate during last quarter was less than one per 1000, both in Merthyr-Tydvil and Reading; whereas it was equal to 6·3 in Stockport, 6·5 in Yarmouth, and 6·5 in Wigan." Again in his report for the third quarter of 1877, at page viii, he says:—"Among the seventy large towns specially dealt with, Leicester and Yarmouth, as in recent years, again stand out conspicuously as suffering from exceptionally high death-rates from Diarrhœa, equal tc 5·6 and 5·4 per 1000. Other causes than those embraced by the theory that summer Diarrhœa is merely dependent upon temperature, must be assigned for such Diarrhœa fatality as that suffered year after year by the infant population of Leicester and Yarmouth."

The attention of the Local Government Board was also directed to the excessively high Diarrhœa death-rate in Yarmouth; and by order of that Board the following report was prepared and forwarded them. Its figures relate to the summer of 1876.

**Report** to the *Local Government Board* upon certain sanitary defects existing in the town of Great Yarmouth, productive of Diarrhœa:—

"For an account of the General Sanitary Condition of Great Yarmouth, the recent report of Dr. Airy to the Local Government Board, supplies so exceedingly well, such an abundance of information, that it will be unnecessary in this report, which is to treat more especially of Diarrhœa fatality, to recapitulate what the Doctor has said in relation to the Topography, Population, Industry, General Health, and many other matters of sanitary importance; but his observations upon 'the dwellings in the Old Town' and 'the dwellings in the New Town' so materially assist in recognising some of the causes of summer Diarrhœa which has periodically visited Yarmouth these last several years, that I make no apology for transcribing them. He says, 'Yarmouth, lying between the sea on the east and the river haven on the west, consists of two portions, the Old Town on the west side, which is chiefly concerned with the river quay, and the New Town on the east, which has sprung up mainly to meet the demands of pleasure seekers by the sea-side. The boundary between these two portions is the old flint-faced town wall, which, though breached in many places, may be traced from the head of the north quay on the bank of the Bure to the foot of the south quay on the bank of the haven, enclosing an oblong space about a mile in length (from north to south) and 300 yards in breadth, with a general westward slope to the haven. This space (the Old Town), densely filled with houses, is traversed from end to end by two or three main streets, and crossed from east to west by 156 narrow cobble-paved passages called 'Rows,' about five feet wide. * * * *

"'Between the rows the space is utilised to the utmost. Houses that cannot be entered directly from the streets or from the rows are entered from narrow courts, reached by archways; the backs of the dwellings crowd close upon one another. Some, though not many, are built back to back; the back yard space is retrenched to the very utmost, and in addition is generally choked with unnecessary cross walls and various structures which interfere with the movement of the air. * * * *

"'In the newer quarters of the town, which stretch to north and south as well as to east, many of the worst features of the old-town dwellings are repeated; there is the same wretched want of space at the back, the same shameful crowding of habitations into the smallest area that can be made to hold them. * * * *

"'Many houses have been built on soil of unwholesome character. In former times a moat ran outside the whole length of the town wall, and thirty years ago a great part of it still remained at the north-east corner; the middle portion had been filled up, part of the southern portion existed as a public open cesspool, and for many years received the excremental deposits from a large part of the town. In recent times these filthy swamps have been filled up with rubbish and house refuse of various kinds, in great part organic and capable of putrefaction, and not only have houses in great numbers been built thereon, but wells have been sunk in the impure soil and the houses supplied with water which has percolated through successive layers of filth.'

"In addition to the ancient moat immediately outside the town walls, and its filthy dilated remnants mentioned by Dr. Airy, the sandy plains between the town and the sea were formerly covered with the filth and refuse from the town; also in a space immediately to the south of the present St. Nicholas' road, 'those who died of the plague in 1579 were buried. Their bones have been frequently disturbed by the sinking of wells and digging foundations.' (Palmer's *Perlustration*, vol. iii., p. 27.) Upon this unwholesome subsoil a large portion of the new town of Great Yarmouth is built.

"The terraces, &c., however, which skirt the sea-shore, and where visitors are chiefly housed, are built upon clean sand. As the sea recedes, which it has ever done, the buildings are extended towards the east, and that which was beach a few years since is now a fashionable district occupied with hotels, terraces, lodging houses, &c. This portion of the town, most frequented by visitors, has been singularly free of Diarrhœa; but between this locality and the town wall, and in a district corresponding to 'the unwholesome subsoil area' mentioned above, nearly 50 deaths have this year happened from Diarrhœa.

"It is in this district, and also in the old town, that well water more especially is drank—water of the vilest description, giving dense precipitate of the brown flocculent matter, with nesseler test, and large quantities of chlorides with silver nitrate. Very many privies also exist hereabouts.

"In the old town about 36 deaths have this year been caused by Diarrhœa; of which 20 were in the rows. Privies of the worst description are universal in the old town. The lodging houses, &c., next the beach are supplied by the Great Yarmouth Water Company, and have water closets, lavatories, &c.

"Throughout the town Diarrhœa has generally happened where polluted water, polluted soil, and polluted air are 'in sweet accord.'

"A medical gentleman, engaged in extensive practice in Yarmouth, last summer carefully noted the water supply of his Diarrhœa patients, and he found an immense majority of the poor sufferers were drinking the miserable filth from the wells, and but very few were drawing their supply from the Company's mains.

"The large accession of visitors this town receives during the summer, causes great overcrowding of not only the larger houses but also of the smaller ones, and these not so favoured in sanitary requirements as the better class of lodgings, soon become more unhealthy than they ordinarily are. During last summer no less than 54,681 visitors were recorded arriving in this town. Very many others came by ordinary trains, of which no record could be kept. So, probably, no less than 60,000 persons sought this popular watering-place during the season for pleasure or health.

"Such large additions to the ordinary population not only causes an increase in price of provisions, but also a dearth of the more wholesome kinds, and frequently articles of questionable purity are consumed, producing thereby more or less sickness. Much of the summer Diarrhœa is undoubtedly due to incautious feeding.

"I consider the drinking of impure well-water largely contributes to the Diarrhœa sickness, and the Sanitary Authority acting upon my advice, are closing a great number of impure wells; in fact, all I report polluted. New wells are disallowed.

"I also think the present privy system most obnoxious, and the Sanitary Authority prohibits the construction of privies to new houses, if a sewer is conveniently near, when water closets are insisted upon; but where this cannot be done it is *sine qua non* that the privy pit has impervious sides and bottom, be placed away from the house, and accessible to the night-soil men. When old privies are reconstructed the above requirements must be complied with. The Sanitary Authority are developing a service of public night-soil men, which every year becomes more efficient.

"The Sanitary Authority are also exercising great vigilance over the dimensions and sites of new houses, and anything objectionable in either has to be remedied before the buildings are allowed to proceed.

"The overcrowding of lodging houses during the hot summer months is most detrimental to the health of the inmates, and I should be glad if some system of registration and frequent inspection could be instituted by the Sanitary Authority.

"Another very potent inducive to Diarrhœa is the scant attention many helpless babes receive from mothers more intent (unintentionally no doubt) upon housing lodgers than in nursing their children. Very many of the smaller lodging-house keepers earn sufficient profits from the visitors during the season to pay their rents for the whole year—hence their ardour in the work.

"The best remedy for this evil would be the establishment of day nurseries—a work rather for philanthropy than the Sanitary Authority. Dr. Taylor remarks "that in our Scarborough Creche we discovered that although infantile Diarrhœa prevailed during September, when children were brought to the nursery they rapidly recovered from this affection, but generally had a recurrence of the attack on the following Monday, in consequence of improper feeding when at home on the Sunday." (*Annual Report* for 1875, p. 10).

I beg to offer to the Sanitary Authority the following suggestions, the carrying out of which may do something to remove this annual Diarrhœa scourge:—

1st. The enforcement of a wholesome water supply.

2nd. The demolition of many of the unwholesome tenements in the rows and other crowded parts of the town. The construction of the proposed new Conge street would be a great boon in this particular.

3rd. The speedy abatement of nuisances arising from blocked drains, and from offensive and overful cesspools, privies, &c.

4th. The prevention of overcrowding in lodging houses by the proper licensing of such houses.

5th. The prevention of the sale of adulterated, deteriorated, and otherwise unwholesome articles of food.

# SECTION II.

## SANITARY WORK ACCOMPLISHED.

### NUISANCE REMOVAL.

| | 1876. | 1877. |
|---|---|---|
| Total number attended to by the Inspectors | 764 | 920 |
| Remedied by Inspector's notice only ... | 374 | 465 |
| Referred to Town Clerk to take proceedings | 390 | 455 |
| Notices for the closure of impure wells, and for the laying on of the Company's water ... ... ... ... | 104 | 159 |
| Notices to construct new drains ... | 100 | 15 |
| To cleanse and repair old houses, drains, privies, cesspools, &c. To put up water troughing. To remove pigs. To cease keeping fowls in cellars, &c., and to abate nuisances of almost every kind ... ... ... ... | 186 | 281 |

Many of the 100 notices to construct new drains in 1876 were in connexion with the new sewers then just completed along Southtown road, Stradbroke road, and Bell's Marsh road.

### SEWER VENTILATION.

Early in 1876 the Sanitary Authority caused numerous surface ventilators to be placed on the north and south sewers, and the street gullies to be untrapped. They also erected two ventilating shafts—one in Marlborough square and one at the back of Bideford terrace; and two ventilating pipes—one in the south-east tower and one in the town yard, all in connexion with the southern main sewer. Another ventilating shaft was placed on the Trinity quay, in connexion with the sewer from the Royal Naval Asylum and locality thereabouts. Many years ago there were two shafts erected upon the north sewer—one near the north-east corner of the old church yard and one at the east end of Garrison walk.

The total cost for repairing, cleansing, flushing, and ventilating sewers for the year ending August 31st, 1877, was £666 11s. 6d.

### NIGHT SOIL REMOVAL, ETC.

The system of night-soil removal and town scavengering has undergone great improvement. Not more than four years ago no public nightmen existed. All the privies and dustbins were emptied by private scavengers, who, of course, only attended to those customers who paid best, hence the poorer tenements were sadly neglected. Then the Sanitary Authority undertook the work, employing a staff of men for that special duty. This plan did not work so satisfactorily as was wished, and therefore it was finally determined to farm out the night-soil removal, the contractor being bound to empty all privies, &c., free of charge to the public, he having the soil and being paid by the Sanitary Authority £77 7s. 3d. per month. This arrangement extends to Yarmouth, Southtown, and Cobholm Island. In Gorleston the night soil is removed by nightmen directly in the Authority's employ, and on account of the rural character of the locality, the sale of the manure to the neighbouring farmers well nigh covers the expense the Authority is at collecting it.

The total cost of scavengering the whole Borough, including night soil removal and street sweeping, was for the year ending August, 31st, 1877, £3035 15s. 2d.

### INFECTIOUS DISEASES HOSPITAL, ETC.

In February, 1876, the Sanitary Authority contracted with Mr. J. F. W. Bray for the building of an Infectious

Diseases Hospital, a detached Convalescent Ward, a Mortuary, a Disinfecting House, an Ambulance Shed, and a Laundry, with other necessary offices. Also to enclose the whole establishment with a high wall. The contract was completed, and the place occupied by the end of the year. The following description of this useful sanitoria may not be out of place. With the exception of the Convalescent Ward, all the buildings are of red brick and slate roofs.

The Hospital consists of two large airy wards, each of which is well ventilated by six windows, twelve wall ventilators—six near the floor and six near the ceiling—and a large ventilator in the roof. The floor of each ward is about four feet above the ground, which is dry sand, and the underfloor space is ventilated by six ventilators in the walls. Each ward is warmed with two iron centre stoves, having iron-pipe chimneys passing directly upward through the roof. The wards are well lit with gas and furnished with six beds apiece, with linen presses, tables, chairs, &c.; they also have, in open yards at their further ends, water-closets, sinks, water-taps, &c. A full-sized bath upon wheels and furnished with a tap does duty in both wards· The wards are allotted to male and female patients respectively. In the centre of the building, between the two wards, are the domestic offices, consisting of an ample store room, two bed rooms, and a kitchen. These apartments are occupied by resident nurses—a man and his wife. An ample supply of crockery-ware, patients' body linen, and other sundries, also belong to the institution.

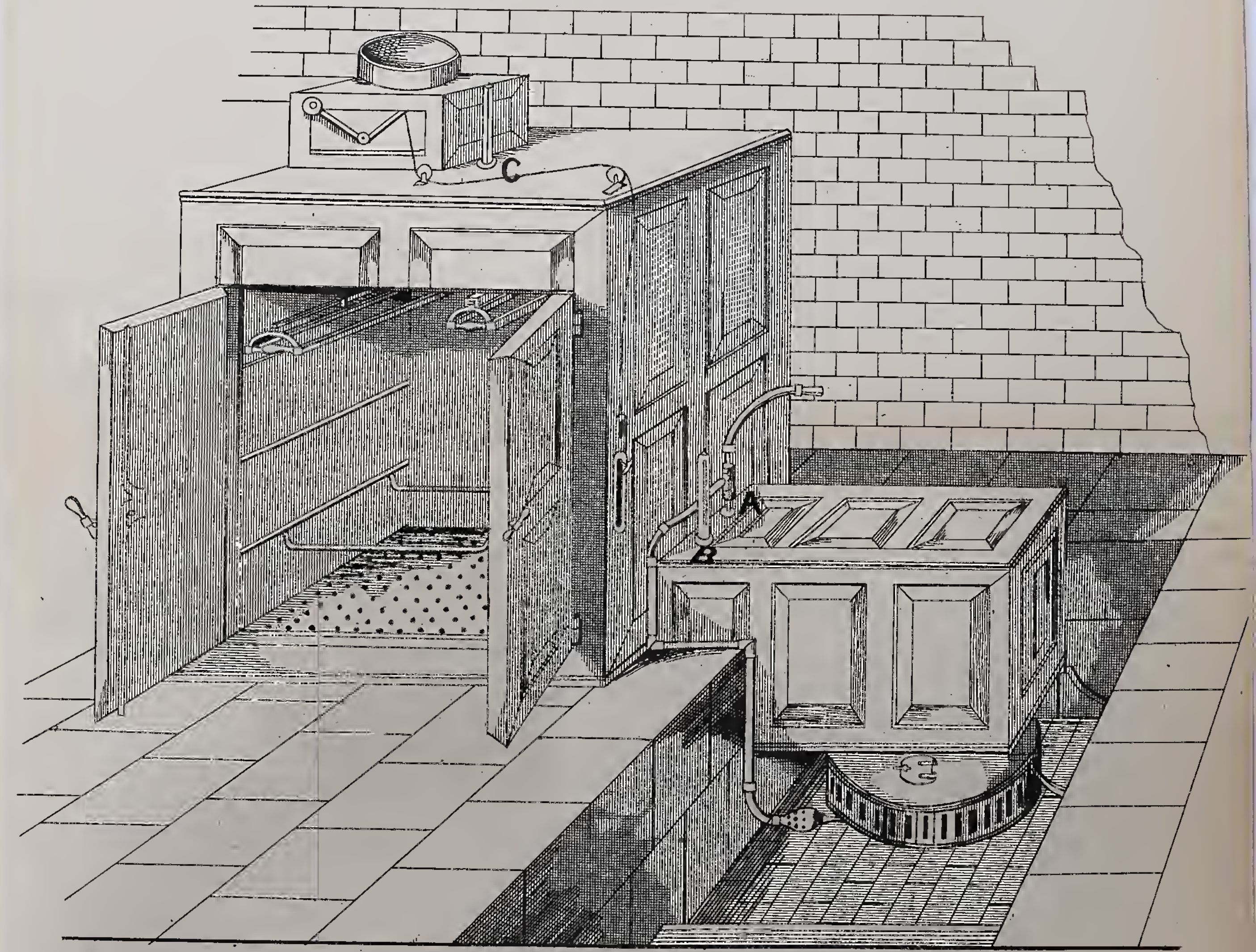
The Convalescent Ward is a wooden building about half the size of the Hospital, to which it is similarly furnished. It is also divided into two portions, to which the necessary offices are attached for male and female patients, with a room partitioned off for a nurse. It contains six

THE SELF-REGULATING

# DISINFECTING STOVE.

SOLE MANUFACTURERS:

GODDARD & MASSEY, ENGINEERS, NOTTINGHAM.



## EXPLANATION.

A Self-acting Gas Regulator.

B Thermometer registering the greatest temperature of the chamber, 255° Fahrenheit.

C Thermometer registering the lowest temperature, 248° Fahrenheit.

beds and is warmed with two centre stoves. In constructing this ward, the possibility of it being required to supplement the hospital, should two epidemics occur at the same time in the town, was kept in view.

The Mortuary is a well lighted and well ventilated roomy building, paved with brick, having a slate table and supplied with gas. In addition to those persons dying in the hospital, it is intended to receive any person dead of infectious disease from houses in the town, whose relatives so desire.

The Disinfecting House contains a Ransom apparatus, constructed by Messrs. Goddard and Massey, of Nottingham. The hospital-keeper disinfects therein free of charge for the public any article of clothing or bedding contaminated with fever poison. For the man's trouble in fetching and carrying back the things disinfected, he is authorized to charge one shilling. The apparatus does its work very efficiently and without the slightest injury to the fabric operated on.

The Ambulance Shed contains a cab, which is used in conveying patients to the hospital, and a large covered barrow for the transit of articles for disinfection.

The Laundry and other offices are at another part of the enclosure, and well provided with boilers, water taps, &c.

The enclosure is very spacious, and around and between the several buildings above mentioned, is planted with flowers, shrubs, and all kinds of vegetables.

During the winter of 1877 a smack's boy from Gorleston and a sailor from a vessel in the Roads were admitted suffering from small-pox: they both recovered. A French fisherman from a Boulogne fishing vessel then in this harbour died here of typhoid in October last. Three or four

June 24, 3 d.

other cases of fever have been received here from the town, one of which died.

The cost of erecting the Hospital, &c., purchase of disinfecting apparatus, laying sewer, gas, and water, from Caister road along Estcourt road to the hospital, purchase of cab, bath, barrow, &c., amounted to £2000. Current expenses for the year ending August 31st, 1877, £92 5s. 6d.

### POLLUTED WELLS.

The Sanitary Authority has been very active recently in closing unwholesome drinking-water wells. An examination has been made of the water from a great number of wells situated in localities where the subsoil was known to be polluted with sewage matter, &c., and in every case the water has been found to be of the vilest description. Mr. F. Sutton, the Borough Analyst, has been good enough to favour me with the following report, which I now respectfully submit to the Sanitary Authority :—

"LONDON STREET, NORWICH, *March 8th*, 1878.

*To the Medical Officer of Health for Great Yarmouth.*

DEAR SIR,

"With very few exceptions the well waters of Great Yarmouth are all alike in character, and are derived alike from surface wells situated in a porous sand, which permits both surface and horizontal underground pollution to pass into them without the slightest obstruction.

"The soil undoubtedly acts as a mechanical filter, and hence many of the waters are clear and colourless, but they are charged with an enormous amount of saline matter, which ought to have no place in waters used for drinking purposes. One of these constituents, namely, nitric acid, derived from animal matter, is constantly present in enormous proportions, together with free ammonia salts, and these are associated also with a great excess of soluble earthy matters, such as chlorides and sulphates of lime and magnesia.

"It is true that a certain moderate proportion of these earthy salts are necessary for bodily health, but nature presents them to us in food in a comparatively insoluble state, so that only the necessary proportions can be assimilated by the fluids of the body. From a long study of the subject I have no hesitation in saying that the physiological effect of the Yarmouth well waters upon human beings is disastrous. They render the blood more fluid than it should be, and have the effect of diminishing the size of the red corpuscles; the general fluids of the body also become highly charged with saline matter, and a state of circulation is produced which highly disposes to typhoid fever, diarrhœa, and eruptive diseases, all testifying to an impoverished state of the blood. Great bodily depression, combined with an artificial thirst, is another result which often tends to the use of alcholic drinks in excess.

Yours faithfully,

FRANCIS SUTTON."

More than 200 of these polluted wells have been closed at the instance of the Sanitary Authority.

The following analyses of well waters have been made by Mr. Sutton :—

| Date. | Situation of Well. | Free Ammonia. | Organic Ammonia as Albumenoid Ammonia. | Chlorine. | Nitrogen as Nitrates and Nitrites. |
|---|---|---|---|---|---|
| | | Constituents in parts per 100,000. | | | |
| 1876. | | | | | |
| March 7 | Theatre Plain .. | 0·006 | 0·028 | 55·000 | 13·262 |
| ,, 13 | Red Lion Alley .. | 0·006 | 0·012 | 48·000 | 7·370 |
| ,, ,, | Apollo Walk .. | 0·100 | 0·080 | 35·800 | 14·740 |
| April 11 | Caister Road .. | 0·200 | 0·100 | 19·300 | 8·100 |
| ,, ,, | Row 11 .. .. | 0·060 | 0·020 | 36·200 | 13.990 |
| ,, 27 | Norfor's Walk .. | 0·006 | 0·080 | 17·600 | 17·680 |
| ,, ,, | Row 31 .. .. | 0·007 | 0·020 | 59·400 | 14·730 |
| May 24 | Red Lion Alley .. | 0·006 | 0·015 | 35·800 | 8·840 |
| ,, ,, | North Quay .. | 0·055 | 0·021 | 136·000 | 2·950 |
| June 9 | Regent Road .. | 0·150 | 0·023 | 15·800 | 5·600 |
| ,, ,, | Hastings' Buildings | 0·003 | 0·020 | 84·800 | 6·630 |
| ,, ,, | Malakoff Place .. | 0·060 | 0·014 | 34·600 | 3·390 |
| ,, 29 | Rainbow Square (*a*) | 0·030 | 0·021 | 59·000 | 10·500 |
| ,, ,, | ,, ,, (*b*) | 0·040 | 0·025 | 215·000 | 20·200 |
| ,, ,, | Row 63 .. .. | 0·015 | 0·024 | 27·000 | 11·100 |
| July 27 | Row 8 .. .. | 0·001 | 0·013 | 129·000 | 7·700 |
| ,, ,, | Row 24 .. .. | 0·000 | 0·025 | 39·200 | 12·600 |
| ,, ,, | Row 48 .. .. | 0·002 | 0·024 | 98·000 | 4·900 |
| ,, ,, | Sutton's Alley .. | 0·100 | 0·020 | 22·000 | 7·480 |
| Oct. 27 | Row 142 .. | 0·000 | 0·013 | 32·400 | 7·560 |
| ,, ,, | Dene Well .. | 0·200 | 0·014 | 32·700 | 7·000 |
| 1877. | | | | | |
| May 25 | Row 87 .. .. | 0·002 | 0·008 | 20·700 | 6·860 |
| ,, ,, | St. Nicholas Road .. | 0·030 | 0·040 | 34·200 | 13·100 |
| ,, ,, | Cemetery Road .. | 0·040 | 0·025 | 14·900 | 3·200 |
| ,, ,, | Caister Road .. | 0·045 | 0·025 | 31·600 | 2·320 |
| Oct. 8 | Isabella Square .. | 0·003 | 0·018 | 34·300 | 6·580 |
| ,, ,, | Howard Street .. | 0·003 | 0·014 | 38·200 | 10·500 |
| ,, ,, | Brunswick Place .. | 0·004 | 0.012 | 25·200 | 7·980 |
| ,, ,, | Row 31 .. .. | 0·005 | 0·014 | 47·200 | 8·680 |
| ,, ,, | St. Nicholas Road .. | 0·003 | 0·012 | 14·600 | 6·580 |
| ,, ,, | The Moat .. | 0·650 | 0·030 | 15·000 | 1·820 |

## *Explanation of the results of Water Analysis,*

BY FRANCIS SUTTON, F.C.S.

"The analysis of drinking waters may be divided into three classes, according to the amount of time and labour given to the examination. The simplest analysis that will suffice for ascertaining whether a water is sufficiently pure for drinking purposes, includes the following details :—

"Estimation of free Ammonia, (product of decomposed sewage.)

"Estimation of Organic Nitrogen in the form of Albumenoid Ammonia, (product of fresh sewage.)

"Estimation of Chlorine, (product of both fresh and decomposed sewage.)

"The results are generally stated in parts and decimal parts per 100,000, or very frequently in grains per imperial gallon.

"An imperial gallon contains 70,000 grains by weight of water, 100,000 grains will therefore measure about a gallon and one-third; this is simply mentioned to assist those who are not familiar with weights and measures; it is not necessary to consider that we are dealing with any particular weight or measure, but with proportions, and therefore it matters not whether we take the result in grains, ounces, pounds, or tons, the relative proportion will be the same. Thus for instance in Dr. Frankland's Report to the Government upon the composition of the water supplied to London by the New River Company in 1870, we find :—

| | Parts per 100,000. |
|---|---|
| Total Solid Matter ... ... | 26·43 |
| Organic Nitrogen ... ... | 0·024 |
| Nitrogen as Nitrates ... ... | 0.206 |
| Chlorine ... ... ... | 1.520 |

"These figures mean that one hundred thousand pounds of such water will contain twenty-six pounds, and forty-three hundredths of a pound of solid matter. The organic nitrogen would be twenty-four thousandths of a pound. The nitrogen as nitrates, two hundred and six thousandths of a pound; and the chlorine one pound and fifty-two hundredths of a pound.

"In estimating the value of any sample of water required for domestic purposes, we must take the results of analysis by comparison.

"Perfectly pure distilled water should contain nothing but water; but as waters which come out of the earth are never perfectly pure, we have to seek for those which shall contain the least possible amount of impurity.

"Waters differ considerably in their amounts of dissolved solid matter, according to the districts from which they are taken. In Norfolk for instance it is scarcely possible to find any spring waters which do not contain considerable quantities of dissolved chalk; this chalk is dissolved during the passage of the water through the soil under pressure, and by the aid of carbonic acid gas. When such waters are boiled and the gas expelled, the chalk deposits upon the vessels in which the boiling takes place. The fur on kettles is a familiar instance of this deposit.

"If waters were, however, merely contaminated with dissolved chalk in moderate quantity, this would not render them unhealthy; it is more especially the dissolved organic matters which constitute the unhealthiness of any water, and since drains and sewers containing objectionable matter, are frequently constructed so as to contaminate springs and wells, the measurement of the amount of such organic impurity is of vital importance.

"The amount of organic impurity in drinking waters, is ascertained from the quantity of nitrogen or ammonia contained in it, and also from the quantity of chlorine.

"These constituents are derived from *animal excreta* or sewage, and may occur in the form of fresh sewage, (albumenoid ammonia), or as sewage decomposed by the effect of the soil through which the water has passed. (free ammonia and nitrates).

"The organic nitrogen, also termed albumenoid ammonia, (or fermentable organic matter), is the form most to be feared, because this represents organic matter of the most objectionable nature, and which has not been purified by the action of the earth.

"The natural soil is endowed with wonderful powers of oxidising the constituents of sewage in water. and rendering them comparatively harmless, converting the albumenoid ammonia into free ammonia and nitrates; but waters which contain free ammonia and nitrates are always open to suspicion, since from various causes the renovating power of the soil may cease, and the water may pass into the well unchanged.

"Deep wells in cities and towns almost invariably contain considerable quantities of free ammonia and nitrates, arising from drainage, but changed by the effect of the soil through which the water has passed. Fleet wells on the contrary will generally contain the sewage matter unchanged, and therefore in the most dangerous form. It must be borne in mind that ammonia, both free and albumenoid, and also chlorine, may be carried into a water spring from artificial manures, as well as from natural manures, stables, &c., chlorine may also arise from sea water, or salt springs; it is always therefore necessary to examine the district for the purpose of ascertaining whether pollution of a water arises from sewage, or from artificial manuring.

"As a general rule any drinking water which contains more than one hundredth of a part of albumenoid ammonia, (0·010 in 100,000), is suspicious, and if this occurs in conjunction with more than 2 or 3 parts of chlorine, derived from sewage, the water is too much polluted for safe use.

"The *hardness* of any sample of water is generally expressed in degrees, according to the scale of Dr. Clark, each degree of hardness representing one grain of chalk in a gallon of water. A very hard water is always objectionable for household purposes, such as washing, &c., much more soap being necessary in the case of a hard water, than of a soft one.

"It is impossible to tell the complete history of any water without a complete analysis, but as this is an expensive process, and not absolutely necessary in all cases, a graduated series of analyses are arranged to suit the wants of the public.

1st. Free Ammonia
Organic Nitrogen, as Albumenoid Ammonia
Chlorine

2nd. Free Ammonia
Organic Nitrogen, as Albumenoid Ammonia
Chlorine
Nitrates
Hardness

3rd. Free Ammonia
Organic Nitrogen, as Albumenoid Ammonia
Chlorine
Nitrates
Hardness
Lime and Magnesia Salts
Iron, Silica, Alumina, &c.

"For the first class of analysis, it is necessary to send not less than two wine bottles; for the second, three or four ditto; for the third, two gallons. Great care should be taken that all bottles are thoroughly clean before being filled with water."

## SECTION III.

### SANITARY WORK REQUIRING TO BE DONE.

The attention of the Sanitary Authority is frequently directed, during the summer months, to the offensive character of several of the public sewers. The following general account of the sewers will show how the nuisance originates, and at the same time indicate its remedy.

The new town, outside the town wall, is drained principally by two large main sewers, commencing about Regent road and running respectively north and south, gradually converging to the north-west and south-west, and finally taking a direct west course to enter the river near the northern and southern extremities of the town wall. These sewers are called the "north" and "south" sewers, and together form a semi-circle, completely encompassing the old town on the north, east, and south sides.

The flatness of the ground they traverse, and the length of these two sewers, preclude them having much fall, but the inclination, what there is of it, is towards the north and south from Regent road. In the course of these large sewers many lesser ones enter them from right and left. It is into these smaller sewers and their numerous branches that the house drains, &c., empty themselves. The further these lesser sewers ramify from the mains the less their calibre and the less their fall; in fact some of the very distant small drains are at a dead level.

The area thus drained by the north and south Sewers and their branches—*at the level of the Sewers*—will represent a cresentic valley, stretching round the north, east, and south sides of the town.

The Regent Road represents a ridge crossing the valley well nigh its middle, and giving a watershed towards the north and south. The Marine Drive and locality along the beach forms the east border of the valley, whilst the district adjacent the town wall forms the opposite border.

The district representing the east side of the Drainage valley is the most important of the whole town, being covered with mansions, terraces, hotels, and the best lodging houses. The nearer the sea the better the class of house; but nearness to the sea also means the greatest distance from the main sewers and the least possible fall for the house drains.

This arrangement is most unfortunate, for the numerous waterclosets of hotels and large lodging houses need ample drains at a good fall. Also being placed on the edge of the drainage valley, and therefore at the highest point and end of the drainage system, the sewer gas naturally collects more especially in the drains and sewers about these houses, and escapes into the interior of many of them through the watercloset soil-pipe, water spout, and many other means of ingress.

It must also be remembered that the sewers empty themselves into a tidal river, and therefore during the time the tide is up no exit of sewage can take place. The sewage thus shut up in the sewers is continually increasing, and at the same time decreasing the space occupied by the sewer gas, which of necessity is forced back up of the smaller sewers and out at any exit it may find.

The plan of flushing the sewers by letting in the tide at high water and out again at low water, only need be mentioned to be condemned; it has the same effect of forcing the sewer gas into houses, but with immensely augmented power. Similar results follow upon heavy rains, if the tide should just then be high. Should contrary winds accompany the rain, as is sometimes the case, so as to keep the tide up in the river, the sewers may not be able to thoroughly empty themselves for several days together, for beside their usual complement of sewage, they then contain an immense quantity of storm water.

The result of this detention of sewage in the sewers is putrefaction of the organic material and evolution of dangerous and offensive gases. This constitutes the nuisance complained of, and in order to obviate it, the sewage must be prevented as much as possible stagnating in the sewers, in other words, the sewers must be washed out clean and well aired; *i.e.*, they must be frequently cleansed, constantly flushed or irrigated, well ventilated, and provided with covered reservoirs.

The ventilation, to a considerable extent, has been accomplished, but it is desirable to carry this much further. Every sewer should be plentifully supplied with surface ventilators, and the head of every small sewer supplied with an iron ventilating tube, carried high above the surrounding houses and surmounted with one of Boyle's or Banner's ventilating cowls. By thus exhausting the sewers through the pipes by means of the cowls, the surface ventilators will become really *inlets* of fresh air and not *exits* of sewer gas as is now the case.

The cleaning of the mud and soil from the interior of the sewers should be done frequently, at least once in two months, and at every place where it is possible for a man to get down into the sewer.

The flushing should be done every two or three days in summer, especially to those sewers near the beach. In winter possibly once a week would suffice. A volume of water, sufficient to fill the sewer, should be thrown down each time, so as to sweep before it every obstruction. In Swansea many of the sewers "are flushed by self-acting receptacles at intervals of from four days to a week, in the following manner :—a receptacle balanced on an eccentric axis is gradually filled with water, which, when it reaches a height in the receptacle representing a quantity of about 150 gallons, is suddenly discharged into the sewer, the receptacle immediately returning to its place to be again refilled." A plan better suited for Yarmouth would probably be a large iron tank on wheels with a large tube from beneath it, to communicate with the head of the sewer. The tank being placed in position, over a sewer, could be filled from the water mains, and the instant opening of the valve beneath, giving free exit to a large volume of water, would effectually cleanse the sewer.

Irrigation is the continual flow of a streamlet of water, and might with advantage be applied to those small sewers or drains which are laid at a level.

The construction of ample covered reservoirs, well ventilated, at the mouth of each sewer, as has been done at Gorleston, would meet the tidal difficulty completely ; for in these receptacles the sewage could collect during the time the tide was too high to allow of its direct outflow into the river.

The Old Town (within the town walls) is drained with shorter and smaller sewers, having generally a westerly fall direct to the river. The surface drains in the rows, in great measure obviate the necessity for underground sewers ; indeed it would be somewhat difficult to construct sewers in the majority of the rows, for in digging a trench deep enough to take the drain, the stability of the property on either side would be endangered; hence only a few of the wider rows are underdrained. The "old town" sewers greatly need copious flushing and ventilating.

The Gorleston and Southtown sewers, although recently constructed, are devoid of flushing and ventilating arrangements, which ought to be supplied.

Only one public main sewer exist in Cobholm Island, and it is without ventilation. There is urgent need of more sewers to right and left of Cobholm main, and the whole system should be properly appointed for flushing and ventilation.

## GORLESTON CHURCHYARD.

The only public burial place within the parish, is already over full, and ought to be closed at once. Its extent is only about four acres, and has been so frequently buried all over that it is difficult, almost impossible, to dig a grave without disturbing recent human remains. The present population of Gorleston and Southtown is estimated at 8,502, and is rapidly increasing. The formation of a "Public Cemetery" somewhere about the western limits of the parish, so as to be easily accessible from Southtown as well as Gorleston, and yet sufficient away from the town, would be much better than enlarging the present churchyard, which ere long will be hemmed in by new streets and houses.

## THE SLAUGHTER HOUSES.

These are a collection of rotten old sheds, adjoining the east or outside the town wall, immediately to the north of the Market gates. They were erected in 1676 by the Corporation, upon a piece of low waste ground, the site of the old rampart ditch, which had become filled up with town refuse. Prior to the above date the principal slaughtering place in Yarmouth was on the east side of the Market place, where the "Butchery" now stands; indeed the old "flesh shambles," as these places were then called, were slaughter houses and butcher's shops combined. The statute of the 4th Henry VII, c. 2, which forbad any beast being slaughtered within a walled town, necessitated the erection of extra-mural slaughter houses, and these are the places the Yarmouth Corporation provided. It would have been better had they been erected further away from the town, for their present position is but a stone's throw from where they formerly stood, and therefore their annoyance to the inhabitants scarcely less, but as the law was literally complied with, the question of health, which was really the spirit of the law, was entirely ignored, and only the convenience of the butchers considered. However, the Corporation could not long keep their eyes shut to the many nuisances that rapidly grew up in connection with them, and therefore in 1681 they made regulations for the constant cleaning of the slaughter houses, for prohibiting swine being kept there, and for the appointing a public officer to inspect them twice a week; and in 1696 they ordered "the blood pit near the slaughter houses" to be filled up. Their present sanitary condition is deplorable. They are horribly offensive, and altogether thoroughly prejudicial to the public health.

On account of the growth of the town to the eastward, beyond the town walls, these slaughter houses are now in the centre of the present town, and completely encircled by a thickly-inhabited locality. If in early days when the slaughter houses were outside the town, it was necessary to enjoin their cleanliness to prevent the nuisance arising from them injuring the public health, how much more necessary is it now to remove the nuisance once again to the outside of the town, and to such a distance as to prevent the possibility of them ever annoying the inhabitants of Yarmouth?

A properly appointed public abattior on the North Denes, where all slaughtering should be done, would rid the town of a gigantic nuisance.

*Resumè*—

The supervision of the lodging houses.

The closure of all polluted wells.

The improvement of the sewers, *viz.* their flushing, cleansing, and ventilating.

The abatement of the slaughter-house nuisance, and the erection of a public abattior.

A public cemetery for Gorleston.

In concluding this report, I beg to thank the Chairman and Members of the Sanitary Committee for the earnest consideration they have always given to all matters I have brought before them, and for the very zealous manner in which they have acted upon my advice.

I would also acknowledge the very efficient assistance I have had from the Town Clerk and other officers of the Corporation.

And am, GENTLEMEN,
Your obedient servant,

JOHN BATELY,
*Medical Officer of Health.*

---

COOPER AND SON, STEAM PRINTERS, GREAT YARMOUTH.